

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

September 2013 examinations

Subject ST9 – Enterprise Risk Management

Introduction

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

D C Bowie
Chairman of the Board of Examiners

January 2014

General comments on Subject ST9

The ST9 exam generally requires bullet point form or short form essay style answers that apply general principles to directly address specific circumstances. The answers given below are just one possible set of acceptable answers. Candidates are awarded marks for all reasonable answers including different but still reasonable numerical solutions. Marks are awarded for working in the case of numerical answers.

Candidates' answers are made up of a series of points. For example, a point can be stating a valid type of risk, describing the type of risk or (part of) a calculation. Some points are more fundamental to the correct answer but, in the main, candidates earn one-half mark per correct point up to the limit of marks available for the question.

Comments on the September 2013 paper

The paper had a balance of bookwork and mini case study style questions. Some of the questions were loosely based on actual events. Examples include the risks associated with life insurance products and logistics. Practical examples of ERM are extremely common place in the press. Candidates should find that regular reading of financial press will prove to be very helpful to their understanding of the issues and concepts contained in the core reading.

Well-prepared candidates scored acceptably well across the whole paper. The comments that follow the questions concentrate on areas where candidates could have improved their performance.

1 For both types of risk, data are needed for both severity and frequency.

There are different types of credit risks. The main distinction is between government, companies and individuals.

For credit risk, frequency refers to the probability of default and severity to the expected level of recovery which can be made (or the expected loss) given default.

There are a variety of sources of data on the levels of credit risk.

And these are more likely to be subject to greater scrutiny or review than operational risk data, therefore more likely to be robust.

And similarly are more likely to be up-to-date.

For example credit agencies may provide information on the level of financial soundness of a counterparty (and ratings can be a condition of some stock market listings).

If the company is listed it will have a market price which will give some information on the likelihood of default.

Spreads on corporate bonds and credit default swap spreads can also give some insight.

Operational risks are more likely to be heterogeneous than credit risk events and so it may be necessary to do more detailed analysis of data splits.

Information on operational risks from errors in internal processes will be generally available.

However there is a risk that some data will not be available as staff may not record near misses which may affect their remuneration.

There will also be operational risks that do not happen often, but which are severe enough to bring down a company if they transpire, e.g. a large one-off fraud.

The data for such risks will be very scanty.

External operational risk data may be more credible, but is unlikely to be relevant to the specific company.

Particularly reflecting its actual operating processes, business mix, size and environment and the governance, controls and other mitigation actions which have been implemented.

It is more important for operational risk data than for credit risk data to take into account the specifics of the company.

Expert judgement is more likely to be required for operational risk data.

Experts may also be needed to construct worst case scenario examples for analysis.

However, credit risk is likely to be more influenced by external events (e.g. general state of the economy) and so therefore it may be necessary to adjust historic credit risk data to reflect aspects such as the economic cycle and also to adjust appropriately for significant contagion events (to which credit risk events are likely to be more prone).

The question was handled well by most.

As ever, additional marks were given for other valid answers including:

- *operational risk data is more sparse.*
- *operational risk data is more qualitative.*
- *operational risk data is often the result of relatively unique circumstances and difficult to categorise by risk factor*
- *credit risk data is widely available from many sources, much more quantitative and able to be grouped for analysis*

2 Selling futures contracts would provide a quick way of mitigating Snooze Air plc's exposure to falling aviation fuel prices.

Futures contracts are transacted through exchanges, which improves the liquidity and also removes the counterparty risk between Snooze Air plc and the ultimate purchaser.

However, there are two important issues with the mitigation strategy:

Forward contracts are not generally subject to margin requirements, whereas futures contracts are.

If this mitigation strategy was executed, the company would need to submit margin if the price of aviation fuel subsequently started to rise, potentially leading to liquidity issues.

In addition, the forward contracts and futures contracts may reference differing measures of the price of aviation fuel, exposing the company to basis risk.

There is a lesser issue that futures contracts are generally more standardised, and therefore Snooze Air plc would have less flexibility e.g. in delivery date.

This straight-forward question was handled well by most.

3 (i) Tools

- SWOT analysis: considers both the downsides and the positive implications of risk for future strategies, through the identification of strengths, weaknesses, opportunities and threats.
- Risk check lists or taxonomy: reference lists of possible risks, sourced from information obtained through experiences and from external documented knowledge.
- Risk prompt lists: higher level categories intended to prompt a more specific list, e.g. PEST (political, economic, social and technological) analysis.
- Risk trigger questions: lists of situations in particular areas of an organisation that can lead to risk, based on previous risk events.
- Case studies: “real world” examples can suggest specific current risks if clear similarities with own organisation, otherwise could suggest areas where similar risks might occur in future.
- Risk-focussed process analysis: construction of detailed flow charts for every process in the organisation and analysis of the points at which risks and failures can occur.

Techniques

- Brainstorming: unrestrained or unstructured discussion involving experts, led by an experienced facilitator in order to draw out a wide range of ideas in depth.
- Independent group analysis: all participants document their views on risks in silence and without collaboration, in order to avoid bias; these are aggregated by a facilitator and then discussed.
- Surveys: questions about different aspects of the area(s) being considered and related risks are distributed to a large number of staff.
- Gap analysis: a survey-based approach seeking to answer two questions: the desired level of a given risk and its actual level; the two questions would not necessarily be asked of the same people.
- Delphi technique: another type of survey with greater flexibility, whereby acknowledged experts are asked to comment on the risks anonymously and independently; the answers are then analysed in detail and follow-up surveys issued until consensus is reached.
- Interviews: these are carried out with specific individuals, with clarification being sought immediately on any unclear answers.
- Working groups: once a risk has been identified, small groups of experts familiar with the risk can analyse and discuss it further.

This straight-forward question was handled well by most.

(ii) ABC's risk exposures are principally:

- Market risk: This is the risk that the investments in the ABC endowment fund underperform or are subject to losses in market value. The structure in itself does not particularly enhance or detract from the management of

market risk. However it could be argued that it creates conditions conducive to good market risk management by increasing the transparency of the fund.

- Reputational risk: There may be additional reputational risk of the structure being perceived as “hiding” the way in which costs are met. There may also be potential reputational risk to the charity if ABC ManCo is not well managed.
- Expense risk: All of the operational costs and therefore the expense risk are now met by ABC ManCo. These are funded from a single source of income – the management fee on the fund. Cost control and managing the sources of expense risk will be important. The form of the management fee is also important. If it is a percentage of funds under management then it should increase in real terms and help to mitigate inflation risk, but there is additional market risk. If it is fixed in monetary terms then there will not be any inflation hedge.
- Operational risk (*could also be described as counterparty risk or agency risk*): As all of the operations of the fund are administered by ABC ManCo, all of the sources of operational risk are within the management company. However, in the event of a significant operational failure of ABC ManCo it is likely that funds from the endowment would be needed to cover these costs. This creates a potential misalignment of incentives (agency risk) or even moral hazard.

This question was handled well by most. Marks were awarded for legal risk providing that the discussion was pertinent.

(iii) **Reputational risk**

The key impacts are likely to be on reputational risk exposure.

- Could create the impression that charity funds are being misused for the benefit of management
- Blurs the line created by the structure between administration and charity
- + Shows thrift – could be portrayed as a cost-saving step, particularly if temporary
- + May allow ABC ManCo to be located in better areas than otherwise, which could allow for better networking

Market risk

- If rent is set to be below market levels then there is an opportunity cost and risk that investment returns are lower than they would otherwise have been
- + although this should be weighed against the costs of holding a vacant property and the nil rental currently being received so also need to consider the likelihood of the commercial rental market picking up again and new tenants being found in the short term

Expense and operational risk

- the rental level could be higher than ABC ManCo would have expected to pay (due to the “prestigious” nature of the vacant property) and this could put pressure on it to cut other costs, which could increase the exposure to operational risk
- If the intention is that ABC ManCo will occupy the property until it can be let on the open market then ABC ManCo is likely to be looking for new premises at the same time as the commercial property market picks up, thus the strategy may be costlier in the long term
- The move itself is not without risk and so moving with the view to moving again in the near future increases the related operational risks.

Many candidates found this question to be a little more difficult. Many answers noted market risk only. As ever marks were given for other valid points including:

- *Increased concentration risk. If the building were to be destroyed then both the charity and the service company would suffer.*
- *Reduced risk of vandalism as the unoccupied building is now occupied.*

- (iv) The lease should be on a short term, renewable basis to allow ABC ManCo to leave when it makes economic sense for the group.

There could be some adjustment to the management fee as a result of the tenancy.

The rent should be at rates which are attractive to both ABC ManCo and to the endowment fund, taking into account all other factors (e.g. at or slightly below market rates).

The contracts and approval process should follow the same process that is used for third party tenants.

Candidates who scored well on part (iii) also scored well on part (iv).

- 4** (i) The standard formula is calibrated to the capital requirements of the “average” insurer in the industry.

It uses a standardised approach to assess the capital requirements in respect of the following risk categories:

- Underwriting risk: The coconut injury product is very unusual. It is highly unlikely that an average approach such as the standard formula will accurately reflect the risk exposures of this product.
- Market risk: Island Life is likely to back its liabilities with a portfolio of short term fixed interest securities. This is a typical investment approach for short term insurance products and so it would appear that the average approach prescribed by the standard formula is appropriate. [However, it may be that some of the local markets in which Island Life operates are not particularly well developed and as a result a more bespoke examination of the market risk is warranted.]
- Counterparty default risk: The suitability of the counterparty default risk module will be similar to the underwriting risk module assessment (reinsurance assets) or the market risk module (all other assets) assessment.
- Operational risk: By definition, under the standard formula operational risk capital is assessed using a formulaic approach. This inevitably means that the standard formula therefore does not capture any firm's operational risk exposures accurately.

The coconut injury insurance product would seem a good candidate for an internal model under Solvency II (i.e. the standard formula is unlikely to be appropriate).

However, although Island Life is the market leader, this could be a relatively low volume product which does not comprise a significant proportion of Island Life's overall portfolio. In which case, also allowing for any diversification with other products, it may be acceptable for the insurer to use a standard formula across the whole business.

Valid points made in the context of the question were given marks.

- (ii) To get internal model approval a model must pass the following tests:
- The “use” test: Firms must demonstrate that the model has not been developed solely for regulatory purposes but is widely used in the firm to support risk management, decision making, economic capital allocations and the solvency capital assessment.
 - Statistical quality standards: The assumptions used in the model should be realistic and based on accurate, appropriate and up-to-date information.

- Calibration standards: This is to ensure that the output of the model reflects the 99.5% (over one year) level of confidence required to set the SCR.
- Profit and loss attribution: The causes and sources of profit and loss for each major business unit need to be analysed at least annually.
- Validation standards: These prescribe the criteria for continual review, monitoring and improvement of the internal model.
- Documentation standards: These set the minimum documentation requirements for the model. Documentation needs to go beyond methodology and audit trail, also recording the theory, assumptions and reasoning behind the model.

This straight forward question was well handled by most.

- (iii) Island Life's current model only covers the frequency of an injury occurring; because of the fixed nature of the payment it does not model the severity of the injury.

To provide full indemnity cover the model will need to be extended to model severity as well.

It will also be necessary to collect any available data on the severity of falling coconut related injuries.

It is unlikely that Island Life has been collecting this information to date given the nature of its product, but there may be a limited amount of information already available.

External sources of data should also be investigated: for example hospitals and universities may have information available.

It may be necessary to use data from similar types of injuries as a proxy.

The availability of relevant research should be investigated.

The insurer needs to consider the extent to which the factors underlying frequency (e.g. number of coconut trees in an area, population density and weather patterns) also impact severity, or whether any additional risk factors are required.

To model severity the company could use a parametric or non-parametric approach.

Given that there is likely to be limited data available initially, a simple approach is likely to be preferable. Such as using an empirical approach rather than fitting a distribution.

The output from the severity and frequency models needs to be combined in some way.

This is likely to require some form of correlation assumption.

The indemnity payment could result in payments being made over a long period of time including hospital and other care costs so claims inflation will need to be considered.

Indemnity payments also increase the risk of the company paying out for things that it didn't expect to cover and hence didn't include in the pricing.

For example, pain and suffering, hair replacement, plastic surgery, lost wages.

It may be difficult to formulate an analytical / closed form representation of the loss model.

In this case a Monte Carlo simulation would be the best way to produce the full loss distribution.

Well handled by many. Other points include:

- *the volume which will be sold is another unknown*
- *and similarly the mix of business (e.g. by risk factor) might differ from the existing product*
- *the use of a copula (for modelling dependencies between frequency and severity)*
- *setting up different types of risk management activities for this product variant (e.g. may set up preferred hospital provider agreements to limit costs), which need to be allowed for in the modelling*
- *there will be new/different operational risks to model, e.g. because claims management will need to be more complex and because it is a new type of product*

- (iv) The company will probably have a limited amount of severity data, which will make meeting the statistical quality criterion considerably harder...

And similarly for the calibration standards criterion – particularly since it is even less likely that there is credible data on extreme events.

In addition the company has no track record of “using” the model as this is a new product – so difficult to evidence for the “use test”.

The company can argue it passes the use test as it used it to develop pricing and it is imbedded going forward and it is a new product.

Similarly the model and product being new makes the profit and loss attribution process more difficult.

Validation should still be achievable, as part of the new model development process, but may be more difficult due to lack of past results against which to backtest.

Although the model is now more complex, the documentation standard should still be achievable.

Overall it therefore may be appropriate to use the standard formula for regulatory purposes at first while the model is fully developed and run in parallel for internal management purposes only.

Most candidates mentioned the paucity of data and the difficulty of passing the use test for new products.

- 5** (i) The range of metrics and approaches include:
- Simple measures such as the amount (by market value or nominal amount) split by each issuing government
 - The difference between the company's solvency ratio as it stands and after applying an adjustment (e.g. a haircut to the market value) for sovereign default risk.
 - The Value at Risk or Tail Value at Risk on the asset portfolio for sovereign default.
 - The Value at Risk or Tail Value at Risk on the overall net asset-liability (solvency) position for sovereign default (which takes into account the fact that much of the risk may be passed to policyholders).
 - Measures of the likely probabilities of default.
 - For example a comparison of government bond yields or credit default swap prices.
 - Estimates of the loss on the bonds should default occur.

The question was well handled by most. The above points are largely metrics. Any reasonable approaches were also given marks including:

- *stress testing, scenarios*
 - *monitor the various government's credit ratings and*
 - *try to estimate the potential contagion between them*
- (ii) Default (or the perception that default is likely) of the local government may lead to a run on local banks with associated adverse implications for liquidity and for Domestic Insurance's ability to sell new business, given its distribution channel.

Domestic Insurance holds a higher proportion of local government bonds and so the direct financial impact of a domestic default would be greater than for a foreign default.

This is particularly the case if the latter portfolio is spread over several different issuing governments although there may be contagion effects.

However, it is often the case that governments default on foreign held bonds before defaulting on locally held bonds. For example, the government could cease to make international payments. This increases the risk of the foreign bonds relative to the local government bonds.

This question was well handled by most.

- 6** (i) An organisation's economic capital is an assessment of the capital required to cover its risks. It is the amount of capital that an organisation requires to cover its liabilities and obligations (or to remain solvent) under adverse outcomes, with a given degree of confidence and over a given time horizon.

Economic value is the present value of all future shareholder profits, determined on a realistic economic basis.

This question was well handled by most.

- (ii) The formula for calculating economic profit is relatively clear and straightforward therefore should be an objective measure that is not particularly susceptible to manipulation.

There may however still be some element of discretion required (and therefore potential for manipulation) if the economic value calculation requires subjective assumptions to be set relating to future experience.

It is a risk-based measure of profit.

It should therefore link better to the true underlying profit of the business than the accounting profit.

However, the accounting profit remains important and economic profit will have to supplement this.

Economic profit links performance measurement to the risk framework.

It will be aligned with the risk appetite framework of the firm.

However it may be volatile, which could have issues in terms of stakeholder communication and buy-in.

It also may be difficult to compare with peer companies.

This question was not well handled. Most candidates did not appear to be familiar with the concept and uses of economic profit. Economic profit is a useful performance indicator and particularly for life insurance companies which write contracts for much longer periods than the 12 month accounting year.

- (iii) + Can provide valuable management information
 - + Could use as a way to link risk appetite and risk thresholds/limits directly
 - + Supports evaluation of the risk / return trade-offs in decision making
 - + Shows that risks can have upsides and downsides
 - The analysis of surplus (or the “expected” figures) on which it is based may be very subjective or contain a number of implicit assumptions which could distort the result or lead to the wrong interpretation
 - The measure may be very volatile
 - It can be difficult to allocate some effects to one particular risk category (or may depend on the order of analysis)
 - How to allow for diversification / correlations between risk drivers
 - A more detailed breakdown might be more useful to gain most benefit from the above advantages

Candidates who had difficulty with part (ii) also had difficulty here.

- 7** (i) Model risk is risk arising from the use of an inappropriate or inaccurate model when assessing or managing risks. It may result in incorrect or suboptimal decisions being made.

A straight-forward question.

- (ii) There should be members with strong technical skills to consider the model methodology.

At least one member of the Committee must have specific experience and detailed knowledge of this model.

But wider modelling exposure would also be useful to help benchmark and consider issues in a more general context.

At least one member should have operational experience of how the output from the model is used by workers on the front line and key decision makers.

There should also be representation of senior management responsibilities and risk management skills.

At least some of the members of the Committee should have formal (relevant) qualifications.

Committee members are not expected to do the work but some of them must have done it or managed it in the past in order to both understand it and check it for reasonableness.

This question was handled well by most.

- (iii) The Model Governance Committee would be tasked with establishing and monitoring:
- The control environment in which the model runs are carried out.
 - The control environment in which the model output is aggregated for reporting.
 - The control environment in which changes to the model are made.
 - The control environment / criteria for model testing.
 - The criteria for the quality of data inputs into the model (e.g. use of the risk register).
 - The criteria for the quality of any assumptions used in the model.
 - The quality of the communication of the outputs, including ensuring that the users fully understand any modelling limitations.
 - Feedback learning loops from any problem deliveries.
 - Training of users.
 - Model documentation.
 - Reporting requirements (to the Committee and to management).

This question was handled well by most. Other valid points include:

- *authorising different levels of access to the model*
- *processes for handling significant model changes in the future*

- (iv) Internal Audit will be independent of the Model Governance Committee.

They would in the normal course of their business be expected to check the general compliance with internal model procedures and use.

And highlight any perceived weaknesses in internal controls.

However, Internal Audit may lack the technical skill sets to consider the accuracy and appropriateness of the model so may need to utilise external experts.

This straight-forward question was handled well by most.

(v) Advantages:

- Quicker to run so can make decisions more rapidly
- And may be more cost-effective
- Possibly simpler to understand and explain
- Which facilitates the embedding of the model into the business
- Metrics produced are likely to be more intuitive – i.e. point estimates rather than distributions
- Produces a more tractable assessment, which could allow the model to link more directly to other types of analyses

Disadvantages:

- Increases the model risk exposure: new / second model and also risk of misalignment between the two models
- It may not be possible to find an appropriate simplified regression which will continue to give optimal or near optimal results
- If an approach is found, it may oversimplify the analyses which could lead to sub-optimal decisions being made which could have a detrimental impact on the company's costs, reputation and business volumes.
- May not be appropriate for considering extreme events, i.e. worst case scenarios

This question was handled well by most. Other valid points include:

- *Disadvantage – time/cost/expertise required to set up and then maintain the regression model.*

(vi) Competitor benchmark times (separated into appropriate risk factors including location and distance) would need to be input into the model as an additional set of parameters.

Setting these parameters is likely to require external / industry data.

Expert judgement may also be needed to supplement this.

Although care should be taken that this does not make the process overly subjective.

The model code needs to be extended: for *each transition* the benchmark comparison time for each competitor will need to be recorded and then summed over each transition stage for the full delivery journey.

These competitor total time outcomes will then need to be compared to the company’s own modelled time outcome.

Where the delivery takes longer than a competitor’s benchmark, the difference should be recorded as the amount at risk.

Where the delivery takes longer than more than one competitors’ total benchmark, the amount at risk would be the maximum difference across all competitors.

Where the delivery is shorter than that of all competitor benchmarks, no contribution to the amount at risk is made.

The analysis of the model output also needs to be adapted.

The simulated distribution of the “reputation at risk” should be compiled from the results of the simulations.

Many candidates handled this question quite well and made the majority of the above points.

8 (i) (a) $_{Gu}\Psi_2(F(A)) = (-\ln(F(A)))^2 = -\ln(0.05)^2 = 8.974412$

and $_{Gu}\Psi_2(F(B)) = (-\ln(F(B)))^2 = -\ln(0.15)^2 = 3.599064$

Summing these and “taking the pseudo-inverse” we get

$$\text{probability} = \exp[-(8.974423+3.599064)^{(1/2)}] = 0.028842$$

OR, directly from using the bivariate version of the formula if remembered:

$$_{Gu}C_2(F(A), F(B)) = \exp[-(-\ln F(A))^2 + (-\ln F(B))^2]^{(1/2)} = \dots = 0.028842$$

(b) By the same process:

$$_{Cl}\Psi_2(F(A)) = 1/2 \cdot [(F(A))^{-2} - 1] = 1/2 \cdot [0.05^{-2} - 1] = 199.50$$

$$\text{and } _{Cl}\Psi_2(F(B)) = 1/2 \cdot [(F(B))^{-2} - 1] = 1/2 \cdot [0.15^{-2} - 1] = 21.72222$$

Summing these and “taking the pseudo-inverse” we get

$$\text{probability} = [2 \cdot (199.5 + 21.7222) + 1]^{(-1/2)} = 0.047488$$

OR, directly from using the bivariate version of the formula if remembered:

$$_{Cl}C_2(F(A), F(B)) = \max \{[(F(A))^{-2} + (F(B))^{-2} - 1]^{-(1/2)}, 0\} = \dots = 0.047488$$

A straight-forward question for well-prepared candidates. Many candidates scored full marks.

- (ii) If there are very poor general economic circumstances then the likelihood of both bonds defaulting is significantly increased. The Clayton copula has lower tail dependency and better deals with this situation, therefore would be preferred. This is illustrated in the higher probability of joint default as calculated in part (i).

Well handled by many. Other answers were accepted providing that adequate reasoning for the choice was given.

- 9** (i) The more onerous conditions need not be included in supply contracts which are not business critical to the company, e.g. where the parts are relatively quickly available from multiple suppliers at a similar price.

Information

- Supplier to provide the company with pre-agreed financial information at pre-agreed intervals.
- Supplier to continuously monitor key financial statistics and advise the company immediately of breaches.
- This could include typical debt style covenants such as debt to equity ratio, liquidity ratio.
- Supplier reports re issues (strikes, legal, machine maintenance etc.)

Penalties

Financial penalties to incentivise the supplier to identify, monitor and manage the risk of failure to meet the contract terms.

These can include:

- comprehensive product guarantees
- free expedited shipping as needed to meet deadlines
- monetary penalties for failing to supply goods on time

Supplier to provide trade credit terms to ensure that payment delays do not affect the timely supply of goods.

Contract to require supplier to maintain pre-agreed stock levels on business critical goods.

Contract to stipulate the process for returning goods including damaged and broken goods.

In particular, the policy for damaged and dead on arrival goods should require immediate expedited replacement at the supplier's expense.

Even though the circumstances of the question were unusual many candidates handled the question well. Other valid points include:

- *requirement for minimum quality testing processes*
- *termination clauses, e.g. if quality standards not met*

- (ii) As these parts are needed very quickly but take a long time to manufacture, the company would likely choose to hold some in stock

There are therefore risks related to storage, including physical risks (loss of stock) e.g. through fire, water damage, theft

And risk of obsolescence

There would also remain a risk of needing more of these parts than are currently held

This could jeopardise its contracts with its customers

The parts appear to be complex and specialised, so there may be greater risk of defect

The following could impact on the company's profit:

- storage costs
- costs of insuring stock
- the impact of the time value of money on stock held for long periods
- stock which has to be dumped due to obsolescence or damage
- loss of business

Many candidates handled the question well. Other valid points include:

- *liquidity risk (having sufficient liquidity to pay for the parts when needed)*
- *counterparty risk (complete failure of supplier) and*
- *unexpected price increases (due to the time delays)*

(iii)

- Specialist shared warehouses co-owned by supplier and a number of customers potentially wanting the same part. This shares the costs of keeping spare parts.
- Rental of goods pending repair. For example, it may be possible to rent certain types of heavy machinery whilst waiting for repairs.
- Differentiated pricing with own customers to reflect different service levels regarding parts that take time to manufacture. This passes some or all of the costs on to the end customers.
- Purchase of fire/theft etc. insurance for the stock storage risks (however although this reduces risk it increases costs).
- It may be possible to purchase insurance to meet end user customer penalties in the event that a part is not supplied on time and this is outside of the control of the company. This could mitigate costs but does not protect the company's reputation.
- In the near future it is likely 3d Laser printer technology could make certain parts on site.
- Could acquire a supply business in order to integrate and control the production process.

Again, this question was well handled by most.

END OF EXAMINERS' REPORT